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TESTING THE INFLUENCE OF TWO ICT MANAGEMENT PRACTICES ON BUSINESS/ICT ALIGNMENT

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Abstract

Business/ICT (Information and Communication Technology) alignment is an ongoing concern for both academics and practitioners. However, little academic research focuses on the process or practice of alignment. In this paper we build a theoretical model and test it empirically. We investigate the influence of ICT management intensity and investment justification on alignment. Four indicators are used for the ICT management intensity construct: ICT portfolio management, ICT performance management, ICT risk management and ICT change management. Investment justification reflects on how organizations justify ICT investments in the business case. We used the following indicators: economic impact, impact on building a competitive advantage, impact on keeping up with the competitors and impact on enhancing management information. Furthermore, we also examined the influence of alignment on the use of ICT for competitive advantage. The study relies on a rich data set of 641 European organizations. Our results indicate that ICT management intensity and investment justification are both positively associated with alignment.

Keywords: Business/ICT alignment, ICT management, Investment justification, Competitive advantage, Structural equation modeling

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Introduction

The importance of aligning investments in ICT (Information and Communication Technology) with business requirements is widely recognized in the literature (Bergeron et al., 2004; Chan et al., 1997; Cragg et al., 2002; Henderson & Venkatraman, 1993; Kearns & Lederer, 2000; Reich & Benbasat, 1996). B/ICT alignment (hereafter *alignment*) *conceptualization* and *justification* have been the locus of attention in alignment research. Different views and conceptualizations on alignment exist (Chan et al., 1997; Henderson & Venkatraman, 1993; Reich & Benbasat, 1996) but most authors agree that, in essence, alignment involves applying ICT in an appropriate and timely way and in harmony with business strategies, goals and needs (Luftman & Brier, 1999). Many studies found that alignment has a positive influence on business performance (Teo & King, 1996; Bergeron et al., 2004; Chan et al., 1997; Cragg et al., 2002). Others have focused on how alignment enables the creation of a competitive advantage for organizations (Kearns & Lederer, 2000, 2003, 2004). However, the existing body of literature provides little guidance on how to achieve alignment between business and ICT. Many studies focus on factors affecting alignment such as industry, organizational size, environmental uncertainty, prior IS success and information intensity in the supply chain (Cumps et al., 2006; Kearns & Lederer, 2000). Yet, there is a strong need for more focused studies on the process and practice of alignment (Chen et al, 2005; Chan et al., 1997; Ciborra, 1997; Hussain et al., 2001; Maes et al., 2000).

A first goal of this paper is to contribute to the body of literature that provides *empirical insight into alignment practices*. We develop and test a theoretical model of the impact of two practices on alignment performance. The second objective of this paper is to continue the resource-based work of Kearns and Lederer (2003) and *investigate the link between alignment and the use of ICT for competitive advantage*. This paper is able to make an important contribution to both research and practice. First, it provides a new theoretical model which includes processes and practices that can be used by practitioners. Next, it provides empirical analyses based on a large European data set comprising more than 640 organizations from 7 European countries. Finally, we do not rely on an alignment measure but treat alignment as a latent variable and use indicators based on the alignment literature.

The first section puts forward the theoretical model and constructs we used in our study. Next, we give a description of the empirical data. This is followed by the analysis of both measurement and structural models and the analysis of the results. Finally, we discuss our findings and the resulting implications for both academics and practitioners.

Theoretical Model

Development of the Conceptual Model

Building on the work of Kearns and Lederer (2000, 2003) we use resource-based theory as the basis of our study. According to the resource-based view (RBV), the organization's bundle of resources, including tangible and intangible assets, knowledge and skills, are the primary predictor of superior financial performance. The logic is that a sustainable competitive advantage can be created when there is *resource heterogeneity* (resources are different) and *resource immobility* (competitors find it hard to imitate or substitute these resources). Therefore, in line with RBV principles, organizations should focus on developing valuable and hard to copy internal assets and processes that can be leveraged as superior capabilities. B/ICT alignment can become the basis of a competitive advantage as the processes leading to alignment satisfy both conditions of resource heterogeneity and resource immobility. Much of the processes but also knowledge and expertise on alignment in organizations is company-specific, tacit in nature and difficult to codify and replicate. Company-specific processes develop in a cumulative and evolutionary matter and generally exhibit path-dependent characteristics (Andreu & Ciborra, 1996). Only those organizations that manage to align business and ICT using their unique mix of company-specific resources create a resource-based view alignment capability that can lead to a sustainable competitive advantage.

Barney (1991) defines three broad categories of conditions that lead to resource immobility and thus, in combination with resource heterogeneity, to sustainable competitive advantage: *path dependency, causal ambiguity and social complexity*. *Path dependency* plays a role as some resources and capabilities can only be developed over long periods of time. Furthermore, some resources and capabilities can only be obtained by an organization in a certain time and place in history. This makes these resources and capabilities imperfectly imitable for competitors. *Causal ambiguity* can be defined as the ambiguity concerning the nature of the causal connections between actions and results. If organizations have difficulties identifying what it is exactly that makes their competitors so successful, the cost of acquiring these resources and capabilities will increase. Finally, *socially complex* resources and capabilities are beyond the ability of organizations to systematically manage and influence. Interpersonal relations between managers, an organization's unique culture and reputation with clients and suppliers are examples of socially complex resources that are costly and difficult for competitors to simply imitate.

The evolutionary-based view of the firm is complementary to the resource-based view as they both support the notion of organizational heterogeneity and give primary consideration to how organizations develop and accumulate company-specific knowledge and expertise that provides the basis for their distinctiveness. Evolutionary economists challenge the idea that organizations only achieve long-term success by innovations and major breakthroughs. Instead, they focus more on continuous learning, knowledge accumulation and gradual build-up of knowledge as a means for organizations to become successful. At the basis of the evolutionary-based view is the concept of *routines*. Routines are the result of past learning efforts and constitute the organizational memory of a firm. Tacit knowledge, know-how, skills and expertise are stored as routines in organizations (Andreu & Ciborra, 1996). The evolutionary view is important to the study of B/ICT alignment in at least two ways. First, it suggests that organizations will not develop high levels of alignment overnight. It will not be sufficient to align an organization once every 2 or 3 years and think everything will work fine. Rather, alignment develops through an extended phase of learning and unlearning, knowledge accumulation and builds on organization-specific routines. Second, the concept of routines combines quite well with the resource-based conditions of resource heterogeneity and resource immobility. The processes leading to alignment are organizational processes that are typically built through organizational learning. These repeated, organization-specific processes or routines are typically difficult to copy. Therefore, in accordance with both RBV and evolutionary economics, it is more likely that organizations can build a sustainable competitive advantage based on their B/ICT alignment and the underlying organization-specific processes, than on technology as such, as this is equally available to all organizations or fairly easy to copy. In this study we look at two organization-specific processes and test whether they are positively associated with B/ICT alignment.

There is still a lively discussion in the literature on whether alignment should be studied as a *process* or an *outcome* (Reich & Benbasat, 1996; Avison et al., 2004). Most studies conceptualize alignment as an outcome, a state or a result of a process rather than a process (Bergeron et al., 2004; Broadbent & Weill, 1993; Chan et al., 1997; Kearns & Lederer, 2000; Reich & Benbasat, 1996). Others argue that alignment should be viewed as a continuous process, underlining the fact that alignment is not a one time activity but a constant balancing act between a lead or lag strategy (Hirschheim & Sabherwal, 2001; Ciborra, 1997; Maes et al., 2000; Luftman & Brier, 1999). We follow the view of Reich and Benbasat (1996) and define alignment as the degree to which the ICT mission, objectives and plans support and are supported by the business mission, objectives, and plans. In this definition, alignment is conceptualized as a state or an outcome, comprised of an *intellectual dimension* (the state in which a high-quality set of interrelated ICT and business plans exist) and a *social dimension* (the state in which business and ICT executives within an organizational unit understand and are committed to the business and ICT mission, objectives, and plans). Therefore, in this paper we will argue that *alignment* is the outcome and the organizational processes are causes that lead to this outcome. As we view process and outcome as separate phenomena, we created constructs for the processes and for the outcome.

In a previous study (Cumps et al., 2006) we used logistic regression on a possible set of 12 alignment antecedents (country, industry, company size, turnover, business strategy, ICT strategy, management intensity, business case maturity, metrics diversity, applications maturity, infrastructural capability and M&A activity) to determine which set of factors were able to discriminate between highly and poorly aligned organizations. The two most important, relevant factors that emerged from that study were management intensity and business case maturity. These results gave us a first indication of the importance of ICT management intensity and ICT investment justification.

This paper further examines the effects of these two factors, *ICT management intensity and ICT investment justification*, on B/ICT alignment. *ICT management intensity* gives an indication of how intensely organizations plan, execute and control their ICT investments. More specifically, it indicates how much resources the organization commits to continuous improvement of actively managing an ICT investment. *ICT investment justification* indicates how much resources are committed to justify why an investment in ICT is necessary/beneficial for the organization. Stratopoulos and Dehning (2000) report empirical evidence that suggests the financial performance of an organization is more related to the way ICT is managed, than the level of organizational spending on new technology. Voss (1986) claims that technology-focused investments fail due to organizational problems, and identified economic justification as a significant contributing factor. Hochstrasser and Griffiths (1991) identified the overwhelming belief of many industries that they are faced with outdated and inappropriate procedures for ICT investment appraisal. We choose to study these two independent variables as they are natural intersections of business and ICT investments. Organizations can first build a business case to justify the investment in ICT. The degree of ICT management intensity both during and after the actual ICT investment determines the organization's commitment to continuous process improvement. A possible association between investment justification and B/ICT alignment could indicate that it offers a first chance for business and ICT to sit together and think about the possible benefits of the upcoming ICT investment. It could influence the communication and partnership categories as described by Luftman (2003). Furthermore, ICT investment justification could also lead to better investment prioritization. This way, projects which contribute better to creating a competitive advantage have a higher chance of getting selected. Once the ICT investment passes the *justification stage*, it must be *actively managed*. A possible association between ICT management intensity and B/ICT alignment could indicate that continuous concern and management keeps the ICT investments in line with business objectives. This would mean that B/ICT alignment needs continuous attention and has to be built-in through the organisation's routines.

As stated before, RBV predicts that the way organizations leverage technology to create new business opportunities is the key to success, not the technology as such. Therefore, it is important to examine how intensely organizations manage their ICT investments. Managerial ICT skills are often developed over a longer period of time and are the result of experimenting and adaptation to the organization's environment. History is important which makes a lot of the managerial ICT skills path dependent. Furthermore, often these skills are tacit in nature (Castanias & Helfat, 1991) and involve a myriad of smaller, interrelated and difficult to pinpoint decisions. This makes these managerial ICT skills causal ambiguous. Furthermore, the interpersonal relationship between business and ICT managers, analysts and architects to manage ICT investments are socially complex. This makes them difficult to imitate. Even if these managerial ICT skills could be written down, codified and transferred, this would not guarantee that they would be as effective and efficient in the other organization. This is because managerial ICT skills are path-dependent and often include and interact with organization-specific elements. Mata et al. (1995) conclude that managerial ICT skills are valuable, heterogeneously distributed across organizations and imperfectly mobile and thus most likely the source of a sustainable competitive advantage. They conclude that the RBV suggest that researchers focus less on ICT per se and more on the processes and structures for organizing and managing ICT within an organization.

Previous studies support our view that ICT management intensity is associated with B/ICT alignment. Earl (1989) sees management of ICT as one of the most crucial aspects for successful ICT projects. According to Keen (1993), when every leading organization has access to the same technology resources, the management difference determines competitive advantage or disadvantage. Henderson and Venkatraman (1993) argue that competitive advantage is obtained through the capability of an organization to exploit and manage ICT functionality on a continuous basis. We found plenty of support in the literature that indicates ICT management intensity as a key predictor for B/ICT alignment (Benson et al., 2004; Earl, 1989; Keen, 1993; Henderson & Venkatraman, 1993; Luftman & Brier, 1999).

This leads us to our first hypothesis:

Hypothesis 1: ICT management intensity is positively related to alignment

Justifying ICT investments is not as straightforward as making a simple ROI or NOV analysis. Intangible benefits are difficult to pinpoint and make that a broad and thorough business case is needed to justify the contribution of the ICT investment to the organization (Cumps et al., 2006). As the nature of ICT changed from simple expenses to investments, funding of ICT project changed along. The business demands that ICT is governed as any other function within the organization. This means that ICT investments should be justifiable. Henderson and Venkatraman (1993) argue that investment justification has a positive effect on B/ICT alignment as it makes visible that ICT investments contribute to business value. Luftman (2003) states that value management and more specifically formal ICT investment assessments impact B/ICT alignment. Benson (2004) argues that investment justification and prioritization are key issues in governing ICT investments. Justifying up-front why an investment in ICT is necessary, is a process that inevitably impacts B/ICT alignment. This leads us to our second hypothesis.

Hypothesis 2: ICT investment justification is positively related to alignment

B/ICT alignment should never be a goal as such. In the end, managers will only be interested in alignment if it somehow impacts organizational performance. However, it has been difficult to empirically link alignment with financial growth or profitability measures. Organizational complexity makes it difficult to show a direct link and effect as there are so many other important variables which we frequently do not consider in the models deployed. An often used surrogate in literature (Kearns & Lederer, 2000, 2003) for organizational performance is the use of ICT for a competitive advantage. The literature on RBV explains that organizational capabilities, such as alignment, and the underlying organizational processes, can create sustainable competitive advantage. Therefore, in this study, we hypothesize that B/ICT alignment can result is an ICT based competitive advantage. This leads us to our final hypothesis:

Hypothesis 3: Alignment is positively related to the use of ICT for competitive advantage

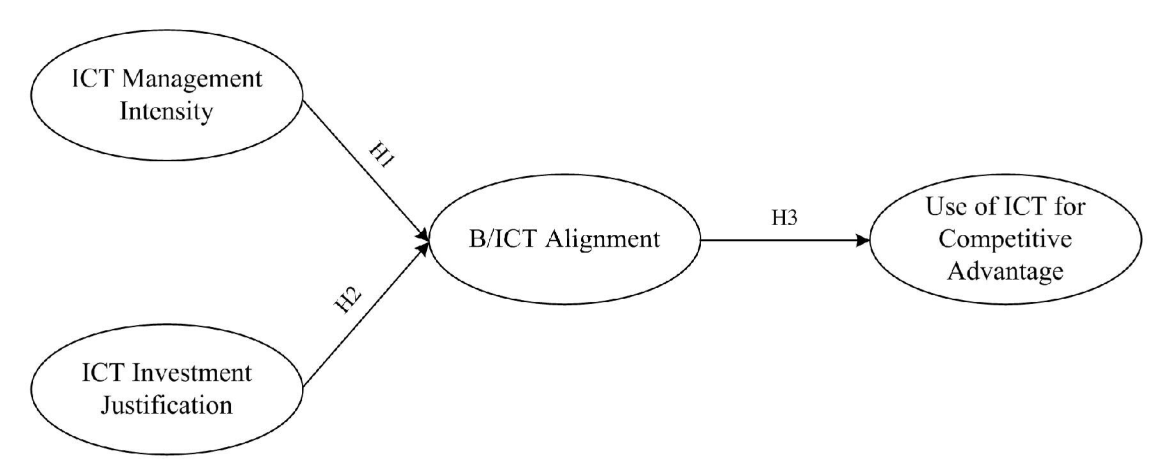

Figure 1: Conceptual Research Model

Operationalization of Constructs

In this study we had to operationalize four constructs. Appendix A gives an overview of the study constructs and survey questions. All of the constructs and construct indicators were selected using a three-phased Delphi test. Based on ideas suggested by Benson (2004) we ended up with four indicators for ICT management intensity i.e. ICT portfolio management, ICT performance management, ICT risk management and ICT change management. We tried to avoid overlap between the indicators as much as possible. For example, ICT project management was not included as risk, change or performance management is sometimes part of project management. Each of these 4 ICT management practices was scored on their maturity using the Capability Maturity Model levels (1= initial/ad hoc, 2= repeatable but intuitive, 3= defined process, 4= managed and measurable, 5= optimized process).

The operationalization of investment justification was based on the work of Parker and Benson's information economics framework. We asked organizations which aspects they include when they justify the ICT investment in a business case. We looked at economic/financial impact, does it help to create a competitive advantage, to keeping up with the competition and to enhance management information.

Latent variables are constructs that cannot directly be measured or observed. For this study, we feel it is more correct to think of B/ICT alignment as a latent construct since it cannot be directly observed although it is presumed to exist. When we conceptualize B/ICT alignment as a latent variable, this construct is measured using multiple indicator variables that each should have an amount of variance in common (common variance) caused by the influence of the latent construct. A non-standard model, where at least one of the constructs is represented as a single manifest variable (for example B/ICT alignment), is only desirable when that manifest variable is a perfectly reliable measure of the construct and you assume that the variable can be measured without error. We feel this is not the case for the B/ICT alignment variable. We ended up with four indicators for B/ICT alignment. Lind and Zmud (1991), Reich and

Benbasat (1996) and Luftman (2003) point out the importance of communication and understanding for B/ICT alignment. Kearns and Lederer (2000, 2003) and Reich and Benbasat (2000) showed that integrated business and ICT planning and management processes positively influence B/ICT alignment. Finally, Reich and Benbasat (2000) argue that shared domain knowledge and a shared vision between business and ICT is one of the most enduring aspects of B/ICT alignment. Performing this analysis with all latent variables has a number of advantages. One is that you have the opportunity to assess the convergent and discriminant validity of the measures. This is important as it provides evidence that you are really studying the hypothetical constructs at interest. Second, it provides the opportunity to work with perfectly reliable causes and effects within your structural model.

As stated before, it is not straightforward to link the use of ICT to organizational performance as there is a strong confounding effect of other variables. An alternative approach is to identify specific uses for ICT that have a proven positive effect (Kearns & Lederer, 2003). For the operationalization of the ICT for competitive advantage construct we used Treacy and Wiersema's (1997) three value disciplines (operational excellence, product leadership and customer focus) as a basis. These value disciplines indicate in which strategic capability organizations invest their specific resources. Compared to traditional financial goals such as revenue growth, profit and business value maximization, value disciplines are better indicators for the strategic direction of the organization. According to Treacy & Wiersema, organizations should focus on one of these value disciplines and try to excel in it, without neglecting the other disciplines.

Empirical Data

We gathered the data using a restricted, web-based survey carried out in seven European countries (Belgium, France, Germany, United Kingdom, The Netherlands, Spain and Italy). Lists of organizations from different industries and different sizes were compiled and all organizations received an invitation and access code. The themes and questions included in the questionnaire were all subjected to a *pre-test.* The Delphi panel consisted of 4 academics with expertise in ICT management and survey design, 2 ICT management consultants and 4 ICT managers. This resulted in some minor modifications in wording. The pre-testing contributed to a survey that is both *academically sound* and has *practical relevance*. For most of the questions, organizations had to evaluate their organizations on a five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree.

Sample Characteristics

From the 790 responses received, we removed responses with too many missing values from the dataset, leaving us with 641 valid responses to the survey. Table 1 gives a breakdown of the sample by country, size, industry, turnover and respondents. We have a nice spread of countries, company sizes and industries in our sample. 22% of respondents are CIO's, 30% are the head of the ICT department and 15% are ICT managers. This means that the majority of respondents (67%) have an ICT related function. Around 10% of respondents are CEO's or business managers. The remaining 22% have other busines functions in the organization.

Table 1: Profile of the Responding Organizations

Range	Frequency	Percent
(a) Participation by country		
United Kingdom	142	22
Belgium	140	22
France	95	15
Spain	97	15
The Netherlands	71	11
Italy	57	9
Germany	39	6
Total	641	100

(b) Total number of employees		
50-99	90	14
100-499	192	30
500-999	64	10
1000-2999	77	12
>3000	218	34
Total	641	100
(c) Participation by industry*		
CIPS	269	42
TICE	167	26
PUBLIC	134	21
FINANCE	39	6
PHARMA	32	5
Total	641	100
(d) Participation by turnover		
< 10 million	115	18
10 m - 49 m	147	23
50 m - 99 m	71	11
100 m - 499 m	96	15
500 m - 999 m	44	7
> 1 billion	154	24
Don't know	14	2
Total	641	100
(e) Participation by position		
CIO	141	22
Head of ICT department	192	30
ICT managers	96	15
Business managers	38	6
CEO	26	4
COO	7	1
Other	141	22
Total	641	100

* CIPS = Consumer and industrial products and services
TICE = Technology, information, communication and entertainment

Analysis of Non-Response Bias

Non-response is the phenomenon that elements of the selected sample do not provide the requested information or that the provided information is unusable. The main problem caused by non-response is that estimates of population characteristics may be biased. This is especially the case when due to non-response some groups in the population are over- or under-represented in the sample, and these groups behave differently with respect to the characteristics that we want to investigate. Unless any indication or proof is presented, we must assume estimators to be biased as not all elements of our sample responded to the survey and since we eliminated some responses.

Ideally, to check for non-response bias, we should gather data from a group of non-respondents and compare this with the data from our sample. However, this method is rarely used is literature as it would require to persuade the non-respondents to help us correct the survey for non-response bias. Most often the non-respondents will indicate the same reasons not to participate in the non-response survey as they did for the original survey. A practical alternative which is often used in the literature (Bergeron et al., 2004; Kearns & Lederer, 2000, 2003; Tallon et al., 2000) is to compare mean values of responses for early respondents with late respondents. The assumption is that late respondents share similarities with non-responders. If no statistically significant difference exists between early and late responders, the likelihood that we have non-response bias a small. We tested 12 variables for the group of early respondents (week 1) and late respondents (week 5). We used three methods of ANOVA (ANalysis Of VAriance)-testing: Scheffe, Bonferroni and Tukey. Differences between means of the two groups were not significant thus indicating that time or non-response bias is small.

Analysis and Results

To analyze the data we used structural equation modeling (SEM) using SAS, in which parameters are estimated by minimizing the discrepancy between the model's implied covariance matrix and the observed covariance matrix. Structural equation modeling is a confirmatory approach that provides explicit test statistics for establishing convergent and discriminant validity. This method is commonly used in MIS and alignment research (Kearns & Lederer, 2000, 2003). We used the maximum likelihood estimation technique (MLE) to generate the smallest possible residual covariance matrix. Based on the suggestions of Anderson and Gerbing, we used a two-staged procedure in our analysis. First, we estimated and refined a measurement model to measure the fit between the theorized model and the observed variables. Next, we use these results to create a structural, path-analytic model to test the hypothesized relationships.

The Measurement Model

A measurement model is a factor-analytic model in which you identify the latent constructs of interest and indicate which observed variables will be used to measure each latent construct. In a measurement model you do not specify any causal relationships between the latent constructs themselves. The latent constructs are allowed to covary with each other construct. The goal of this analysis is to refine the model until we find an acceptable fit between data and the theorized model. We performed measurement modelling on the four model constructs comprising 20 items, 5 for each construct. Based on Lagrange multiplier tests and the Wald test, we dropped 4 multidimensional items. Anderson and Gerbing state that unifactoral variables simplify evaluation and that it is acceptable to drop multidimensional variables when sufficient items remain to operationalize the construct (Kearns & Lederer, 2003). Furthermore, the results from the Lagrange multiplier test identified two pairs of error terms which, if allowed to covary, would improve overall model fit. Therefore, we allowed the error terms of JUS2 and JUS3; and, JUS1 and JUS4 to covary. JUS2 and JUS3 could covary because organizations that look at how a new ICT investment contributes to building a competitive advantage also need to know how it helps them to keep up with the competition. JUS 1 and JUS4 could covary because organizations that look at how a new ICT investment helps to create management information often include economic and financial metrics in the business case. Typically, business executives are more familiar with the traditional financial metrics.

Model Goodness-Of-Fit

We used several goodness-of-fit indices to avoid bias associated with the use of a single index. In line with previous MIS research [38, 39], we chose the following indices: Goodness-of-Fit Index(GFI), GFI Adjusted for degrees of freedom, (AGFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) and the Chi-square statistic. It is generally accepted that the chi-square statistic should be interpreted with caution and supplemented with other goodness-of-fit indices. With large samples and real-world data this statistic will very frequently be significant even if the model provides good fit. Therefore, it has been suggested in literature to assess the chi-square/degrees of freedom index. Many academics use the informal criterion that the model may be acceptable if the chi-square value is less than twice the size of the degrees of freedom (Kearns & Lederer, 2004). Yet, even if this is the case, this somewhat arbitrary criterion should be supplemented with other statistics to assess model fit. Table 2 presents the different goodness-of-fit indices with the recommended value. All measures for the final measurement model suggest a strong fit of the data with the hypothesized model. The results indicate that the final measurement model is acceptable.

Table 2: Goodness-Of-Fit Measures for the Measurement Model

Test statistic	Recommended value	Model statistic
Chi-Square		184.11
Degrees of Freedom		96
Chi-Square/*df*	≤ 2.0	1.91
Goodness of Fit index (GFI)	≥ 0.90	0.97
GFI adjusted for *df* (AGFI)	≥ 0.90	0.95
Non-Normed Fit index	≥ 0.90	0.97
Comparative Fit index	≥ 0.90	0.98
Root Mean Square Error of App	≤ 0.050	0.037

Construct Reliability and Validity

One of the most important advantages offered by latent-variable analysis is the opportunity to assess reliability and validity of the variables. Reliability refers to the consistency of measurement. Validity determines whether an instrument measures what it is supposed to measure. We performed several tests to assess content validity, composite reliability, convergent validity and discriminant validity.

Table 3 Properties of the Measurement Model (n=641)

Construct and Indicators	**Mean**	**Variance**	**Standardized Loading**	**t-value**
ICT Management Intensity (F1)				
MAN1	2.86	1.14	0.69	18.7[a]
MAN2	2.85	1.27	0.78	22.4[a]
MAN3	2.66	1.42	0.82	23.8[a]
MAN4	2.67	1.31	0.81	23.4[a]
α = 0.86 / composite reliability = 0.86 / variance extracted estimate = 0.60				
ICT Investment Justification (F2)				
JUS1	4.19	0.86	0.39	9.6[a]
JUS2	3.57	1.26	0.92	24.6[a]
JUS3	3.44	1.23	0.79	20.9[a]
JUS4	3.54	0.97	0.69	16.2[a]
α = 0.76 / composite reliability = 0.80 / variance extracted estimate = 0.52				
Competitive Advantage (F3)				
CA1	3.57	0.85	0.63	15.6[a]
CA2	3.21	1.19	0.60	14.4[a]
CA3	3.35	1.16	0.71	17.9[a]
CA4	3.87	0.94	0.61	15.1[a]
α = 0.73 / composite reliability = 0.73 / variance extracted estimate = 0.42				
B/ICT Alignment (F4)				
AL1	3.01	0.96	0.77	21.7[a]
AL2	3.19	0.93	0.84	24.9[a]
AL3	3.14	0.96	0.80	22.8[a]
AL4	3.25	0.89	0.68	18.4[a]
α = 0.85 / composite reliability = 0.86 / variance extracted estimate = 0.60				

[a] Indicates significance at $p < 0.0001$ or higher

Table 3 shows all significant t-values. Next, we used the *variance-extracted-estimates test*, which assesses the amount of variance explained by the underlying latent factor as compared to the amount ascribed to random measurement error. The variance extracted estimates indicate that for three of the four constructs more than 50% of the variance is captured by the construct. Both tests indicate overall convergent validity. Finally, a measuring instrument displays *discriminant validity* if the instrument does *not* measure a construct that it was *not* designed to measure. We obtained evidence for discriminant validity using three different tests: the chi-square difference test, the confidence interval test and the variance extracted test. All tests indicated discriminant validity. All of the preceding tests confirm the reliability, validity and goodness-of-fit of the four-construct measuring model. Figure 2 presents the final measurement model for this study, along with the correlations between the constructs. As predicted, all constructs are positively, yet mildly related (all well below the suggested cut-off value of 0.90) (Reich & Benbasat, 1996).

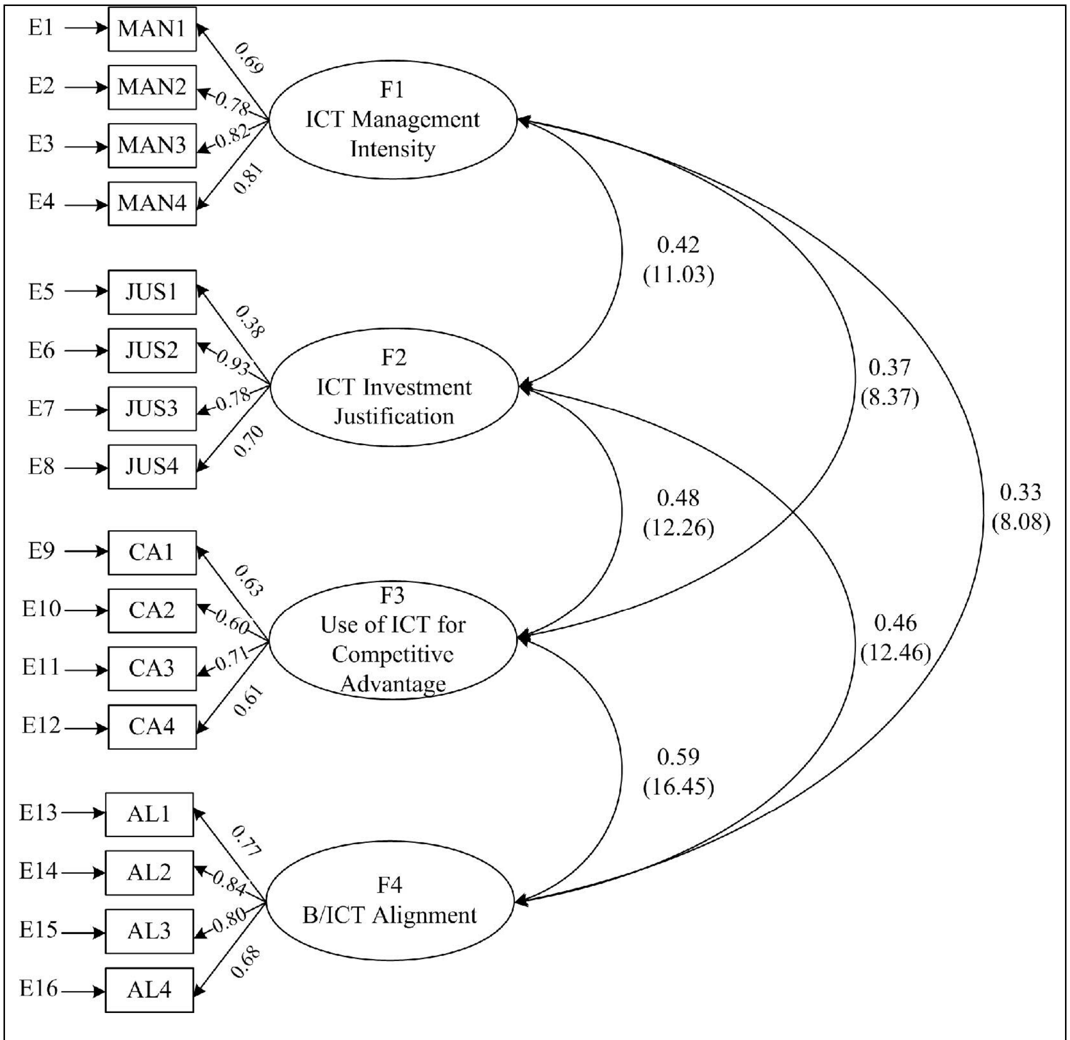

Figure 2: The Final Measurement Model with Construct Correlations and t-test Values

The Structural Model

For the structural model we modify the measurement model so that only the exogenous factors are allowed to covary and the causal relationships between some of the constructs are specified by unidirectional paths. In this structural model we test both measurement properties and causal relationships. Again, we allowed error terms to covary based on Lagrange multiplier tests. This implies that some error terms are affected by a common influence not included in the model. It is not uncommon to allow some of these terms to covary as long as it does not detract from the theoretical meaning of the model, which was not the case. Table 4 shows that the final model is characterized by strong goodness-of-fit.

Table 4: Goodness-Of-Fit Measures for the Structural Model

Test statistic	Recommended value	Model statistic
Chi-Square		221.44
Degrees of Freedom		98
Chi-Square/*df*	≤ 2.0	2.26
Goodness of Fit index (GFI)	≥ 0.90	0.96
GFI adjusted for *df* (AGFI)	≥ 0.90	0.94
Non-Normed Fit index	≥ 0.90	0.96
Comparative Fit index	≥ 0.90	0.97
Root Mean Square Error of App	≤ 0.050	0.044

The path coefficients with related t-values for the final structural model are presented in figure 3. All of the path coefficients are positive and significant ($p < 0.001$) indicating support for the three hypotheses H1-H3. The disturbance term for the dependent variable B/ICT alignment is 0.86. This is the variance due to omitted variables, random shocks and misspecifications in equations. We calculated R^2, the percentage of variability explained by the antecedent variables *management intensity* and *investment justification*. About 25% of the variability of the *B/ICT alignment* variable is accounted for by these two variables. Furthermore, almost 40% of the variability of the *competitive advantage* variable is accounted for by the entire model.

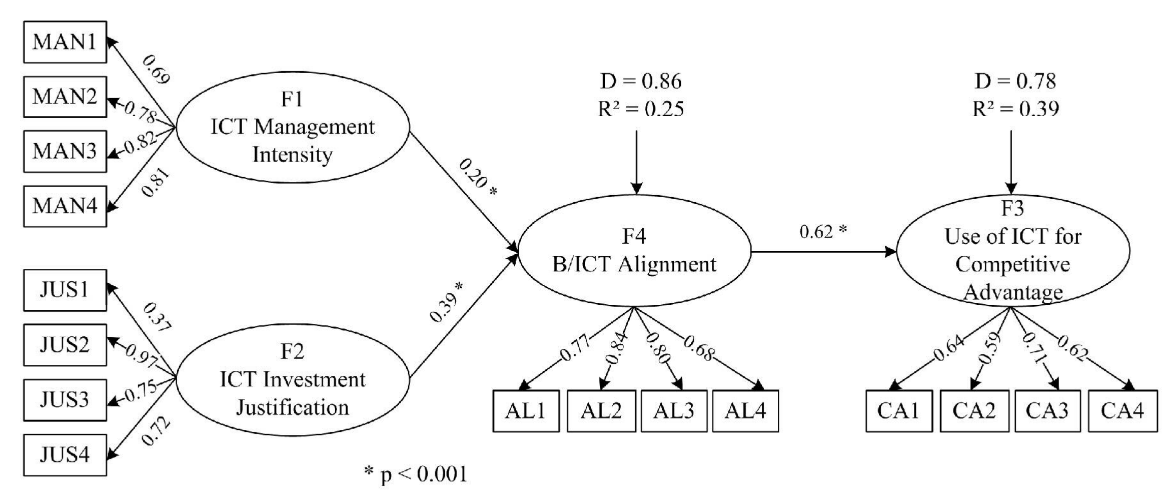

Figure 3: The Final Structural Equation Model with Path Coefficients

Discussion

A first goal of this study was to examine the impact of ICT management intensity on B/ICT alignment. ICT management intensity was found to be positively and significantly associated with B/ICT alignment (H1). This means that increased maturity on these ICT management processes have a positive influence on an organization's alignment. One general explanation is that the introduction of certain ICT management practices such as ICT performance management and ICT portfolio management professionalizes the way organizations deal with ICT investments. The investments are formally guided towards the organization's business goals. Less ad-hoc management and more optimized and formalized ICT management processes clearly narrows the gap between business and ICT. Business executives have more affinity with these management processes which makes it easier to follow up these investments.

Next, we found a positive and significant association of ICT investment justification with B/ICT alignment (H2). It is clear that since the burst of the dot.com bubble, organizations started rationalizing their ICT investments. Therefore, it is understandable that better justification of why a certain investment in ICT is needed, will bring business and ICT closer together. ICT needs a process to make the, often intangible, benefits of the investment clear for business executives. Previous studies (Reich & Benbasat, 2000; Kearns & Lederer, 2003) showed that shared domain knowledge and mutual understanding are strong indicators for alignment. Integrating strategic business and ICT plans at a high organizational level are not the only way to accomplish this. The process of investment justification possibly helps to make the ICT domain more understandable and accessible to business managers.

Finally, there was a positive and significant association between B/ICT alignment and the use of ICT for competitive advantage (H3). RBV helps us to explain this result. The organization's B/ICT alignment is difficult to imitate or substitute and therefore, can be the basis of a competitive advantage. In the following section we elaborate further on this result.

Study Contributions

Our research makes several useful theoretical and practical contributions. First, our results indicates a positive and significant association between ICT management intensity and B/ICT alignment. From both resource-based and evolutionary views on the organization, this means that continuous, intense, every-day ICT management routines positively influence B/ICT alignment. Andreu and Ciborra (1996) state that core capabilities develop in organizations through a transformation process by which undifferentiated resources, available in open markets, are used and combined, within the organizational context of each firm, with organizational routines to produce capabilities. These capabilities can become core and the source of competitive advantage. Both *ICT management* and *investment justification* can be regarded as processes that take place within an organizational context resulting in better *B/ICT alignment*. This alignment is dependent on both these organization-specific processes. This path-dependency is what makes the resulting competitive advantage, at least partly, imperfectly imitable and imperfectly mobile. This model contributes to the development of resources-based theory as a foundation to explain differences in alignment capability and the resulting competitive advantage for organizations.

Second, we have provided empirically validated evidence of the relationships between both ICT management intensity and B/ICT alignment on the one hand and ICT investment justification and B/ICT alignment on the other hand. As such, we identified and validated two processes that contribute to B/ICT alignment. This answers the call from literature (Chan et al., 1997; Ciborra, 1997; Cragg et al., 2002; Hussain et al., 2001; Maes et al., 2000; Sabherwal & Chan, 2001) for more insight on how to actually achieve alignment and the processes that lead to alignment.

Third, this study revealed a significant relationship between B/ICT alignment and the use of ICT for competitive advantage. This helps the stream of literature that uses B/ICT alignment as an intermediate concept to explain how ICT investments can generate business value. Additional investments in ICT management and investment justification processes are parts of the puzzle.

In summary, this paper makes several important contributions. It increases our understanding of the organizational processes that impact B/ICT alignment. Follow-up and more intense management of investments in ICT is positively associated with B/ICT alignment. The study also shows us that justifying investments in ICT, for example in an up-front business case, is positively associated with B/ICT alignment. By illustrating a positive relationship between B/ICT alignment and the use of ICT for competitive advantage, the study provides empirical validation of the usefulness of alignment. As we used a different conceptualization of the alignment construct, this is yet another study that provides the efficacy of alignment.

Implications for researchers

This study provides researchers an interesting area for future research. The R^2 value in our structural model showed that ICT management intensity and ICT investment justification only account for 25% of the variance of B/ICT alignment. Further research is needed to explore which other organizational processes can be added to the processes we described in order to increase the explanatory power of the model. Case study research can be a first step to identify possible candidate processes. The measures and indicators we use in our model are inspired and, at least partly, supported by the research literature. However, further validation in new studies is needed to increase generalizability and credibility of the constructs and indicators we used.

Next, there are also opportunities to broaden the scope of this type of study. We specifically looked at processes. However, based on the resource-based work of Peppard and Ward (2004), researchers could study the mix of *processes, structures and roles (hereafter PSR)* that organizations use to create a B/ICT alignment capability. Peppard and Ward argue that organizations use a mix of PSR to transform *resources* into *competencies* which in turn can be leveraged to create a *capability*. This would mean that we need an intermediate layer (competencies) between the PSR and the capability (i.e. competencies). Luftman (1999, 2003) describes 6 alignment categories that need attention if organizations want to align business and ICT: communication, partnership, value management, architecture, governance and human resources. These can be regarded as the alignment competencies organizations need to develop. For example, the process of investment justification could be part of the value management competence organizations need to develop to create an alignment capability. Based on the work of Luftman, researchers could analyze which set/mix of PSR contributes best to create alignment competencies which need to be leveraged to create an alignment capability.

Study limitations

Despite the contributions, there are inherent limitations of the study that call for caution in interpreting the findings of this research article. First, generalizability of results could be limited as our indicators and constructs could benefit from further empirical validation. Next, we used a surrogate for organizational performance. The use of ICT for competitive advantage is not equivalent to improved financial performance. However, previous studies (Kearns & Lederer, 2000, 2003) also used this construct so we based our choice on previous literature. Third, while theoretically sound, the conclusions are drawn from the responses and perceptions of a single informant in each organization. Although omnipresent in MIS studies, we need to acknowledge that this remains a source of bias when interpreting the results. Furthermore, the use of perceptual measures always raises questions regarding generalizability, validity and reliability. Finally, we need to strongly state that we did not intend to be exhaustive in the selected processes that impact B/ICT alignment. A lot of work in the selection and testing needs to be done in that area.

Conclusion

B/ICT alignment remains an important and interesting issue for both academics and practitioners. With this paper, we tried to answer the call for insight on the processes that lead to B/ICT alignment. In the model we constructed we test three relationships: Between the ICT investment intensity process and B/ICT alignment, between the ICT investment justification process and B/ICT alignment and between B/ICT alignment and the use of ICT for competitive advantage. All three relationships turn out to be positive and significant. With this study, we identified two important processes that contribute to B/ICT alignment in a resource-based view. This study suggests that if organizations both justify and intensely manage their ICT investments, it will have a positive influence on B/ICT alignment. Finally, we demonstrated that B/ICT alignment remains an important enabler of the use of ICT for competitive advantage.

Appendix A. Items used to measure study constructs

Item name	Questionnaire statement
Please rate the level of maturity of the following ICT management practices (ranging from 1 = initial/ad hoc to 5 = fully optimized process) in your organization.	
MAN1	ICT portfolio management
MAN2	ICT performance management
MAN3	ICT risk management
MAN4	ICT change management
Please rate the frequency of use of the following items when building a business case for an ICT investment (ranging from 1 = never to 5 = always) in your organization.	
JUS1	Economic impact, financial metrics
JUS2	Contribution to building a competitive advantage
JUS3	Contribution to keeping up with the competition
JUS4	Contribution to enhancing management information
In your organization … (ranging from 1 = strongly disagree to 5 = strongly agree)	
AL1	Business and ICT speak the same language
AL2	Business and ICT management processes are strongly integrated
AL3	Strategic business and ICT plans are well aligned
AL4	Business and ICT have a shared vision of the role of ICT
In your organization … (ranging from 1 = strongly disagree to 5 = strongly agree)	
CA1	ICT is used to increase flexibility and agility
CA2	ICT is used to increase sales
CA3	ICT is used as a driver for product and service development
CA4	ICT is used in meeting customer requirements

Appendix B. Table of Correlations

Table of correlations

	MAN1	MAN2	MAN3	MAN4	JUS1	JUS2	JUS3	JUS4	CA1	CA2	CA3	CA4	AL1	AL2	AL3	AL4
MAN1	1.000															
MAN2	0.550	1.000														
MAN3	0.545	0.635	1.000													
MAN4	0.552	0.634	0.677	1.000												
JUS1	0.157	0.099	0.107	0.092	1.000											
JUS2	0.305	0.288	0.320	0.268	0.350	1.000										
JUS3	0.276	0.262	0.287	0.218	0.229	0.724	1.000									
JUS4	0.238	0.237	0.276	0.248	0.288	0.490	0.530	1.000								
CA1	0.196	0.206	0.164	0.143	0.100	0.262	0.248	0.231	1.000							
CA2	0.152	0.170	0.175	0.109	0.097	0.337	0.324	0.199	0.358	1.000						
CA3	0.295	0.292	0.241	0.204	0.063	0.315	0.326	0.185	0.476	0.395	1.000					
CA4	0.174	0.153	0.143	0.122	0.084	0.256	0.266	0.162	0.361	0.399	0.442	1.000				
AL1	0.126	0.195	0.190	0.173	0.099	0.338	0.294	0.248	0.283	0.269	0.308	0.247	1.000			
AL2	0.206	0.192	0.236	0.166	0.093	0.352	0.265	0.249	0.333	0.297	0.302	0.347	0.652	1.000		
AL3	0.238	0.230	0.275	0.242	0.062	0.352	0.226	0.240	0.303	0.269	0.358	0.315	0.587	0.689	1.000	
AL4	0.181	0.185	0.226	0.180	0.047	0.306	0.219	0.252	0.299	0.270	0.303	0.215	0.562	0.542	0.529	1.000

References

Andreu, R., and Ciborra, C. (1996). "Organisational learning and core capabilities development: the role of it", *Journal of Strategic Information Systems*, 5(2).

Avison, D., Jones, J., Powell, P. and Wilson, D. (2004). "Using and Validating the Strategic Alignment Model," *Journal of Strategic Information Systems,* Vol. 13, No. 3.

Barney, J.B. (1991). "Firm resources and sustained competitive advantage", *Journal of Management*, 17(1).

Benson, R.J., Bugnitz, T., and Walton, B., (2004). "*From Business Strategy to IT Action: Right Decisions for a Better Bottom Line"*, John Wiley & Sons.

Bergeron, F., Raymond, L. and Rivard, S. (2004). "Ideal Patterns of Strategic Alignment and Business Performance", *Information and Management*, Vol. 41, no 8, pp. 1003-1020.

Broadbent, M. and Weill, P. (1993). "Improving Business and Information Strategy Alignment: Learning from the Banking Industry," *IBM Systems Journal*, Vol. 32, No. 1, pp. 162-179.

Brown, C.V. (2003), "Performance Metrics for IT Human Resource Alignment," *Information Systems Management,* Vol. 20, No. 4.

Brown, C. V., and Magill, S. L. (1998). "Reconceptualizing the Context-Design Issue for the Information Systems Function," *Organization Science,* 9(2), pp. 176-194.

Brown, C.V., and Magill, S.L. (1994). "Alignment of the is function with the enterprise: towards a model of antecedents", *MIS Quarterly*, 18(4).

Brynjolfson, E., (1993). "Productivity paradox of information technology", *Communications of the ACM*, 36(12).

Burn, J. (1997). "Information system Strategies and the Management of Organisational Change", *Journal of Information Technology,* 8.

Burns, J.M., and Szeto, C. (2000). "A Comparison of the Views of Business and IT Management on Success Factors for Strategic Alignment," *Information and Management,* Vol. 37, pp. 197-216.

Byrd, T.A., Lewis, B.R., and Bryan, R.W. (2006). "The leveraging influence of strategic alignment on IT investment: an empirical examination", *Information & Management,* 43(3).

Castanias, R., and Helfat, C. (1991). "Managerial Resources and Rents", *Journal of Management*, 17(1).

Chen, H.M., Kazman, R., and Garg, G. (2005). "BITAM: an engineering principled method for managing misalignments between business and IT architectures", *Science of Computer Programming*, 57(1).

Chan, Y.E., Huff, S.L., Barclay, D.W. and Copeland, D.G. (1997). "Business Strategy Orientation, Information Systems Orientation and Strategic Alignment," *Information Systems Research*, Vol. 8, No. 2, pp. 125-150.

Chan, Y.E. (2002). "Why Haven't we Mastered Alignment? The Importance of the Informal Organization Structure.," *MIS Quarterly Executive*, Vol. 1, No. 2.

Ciborra, C.U. (1997). "De Profundis? Deconstructing the Concept of Strategic Alignment," *Scandinavian Journal of Information Systems,* 9(1), pp. 67-82.

Clemons E.K., and Row, M.C. (1991). "Sustaining it advantage: The role of structural differences". *MIS Quarterly*, 15(3).

Cragg, P., King, M. and Hussin, H. (2002). "IT Alignment and Firm Performance in Small Manufacturing Firms," *Journal of Strategic Information Systems,* Vol. 11, No. 2.

Cumps, B., Viaene, S., Dedene, G., and Vandenbulcke, J. (2006). "An Empirical Study on Business/ICT Alignment in European Organisations". *In Electronic proceedings of the 39th Hawaiien International Conference on System Sciences (HICSS 39)*, Kauai, Hawaii, January.

Cumps, B., Viaene, S., and Dedene, G. (2006). "Managing for Better Business/ICT Alignment

Das, S.R., Zahra, M.E., and Warketin, M.E. (1991). "Integrating the content and concept of strategic planning with competitive strategy", *Decision Sciences*, Vol. 22.

Dedene, G., Viaene, S., Cumps, B., and De Backer, M. (2004). "An abc-based approach for operational business/ict alignment". *In Proceedings of the 11th European Conference on Information Technology Evaluation (ECITE),* Amsterdam, The Netherlands, November 2004.

Earl, M.J. (1989). "Management Strategies for Information Technology," *Business Information Technology Series,* Prentice Hall Europe.

Feurer, R., Chaharbaghi, K., Weber, M. and Wargin, J. (2000). "Aligning Strategies, Processes, and IT: A Case Study," *Information Systems Management,* Vol. 17, No. 1.

Grant, R.M. (1991). "The resource-based theory of competitive advantage: implications for strategy formulation". *California Management Review*, 33(3).

Hsaio, R., Ormerod, R. (1998). "A New Perspective on the Dynamics of IT-Enabled Strategic Change", *Information Systems Journal,* 8 (1).

Henderson, J.C. and Venkatraman, N. (1993). "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," *IBM Systems Journal*, Vol. 32, No. 1, pp. 4-16.

Hirschheim R. and Sabherwal R. (2001). "Detours in the Path toward Strategic Information Systems Alignment: Paradoxical Decisions, Excessive Transformations, and Uncertain Turnarounds," *California Management Review*, 44(1), pp. 87-108.

Hochstrasser, B., and Griffiths, C. (1991). Controlling IT Investment Strategy and Management", Chapman & Hall.

Hochstrasser, B. (1992). "Justifying IT investments", *in: Proceedings of the Advanced Information Systems Conference*, The New Technologies in Today's Business Environment, London, UK.

Hussain, H., King, M., Cragg, P. (2001). "IT Alignment in Small Firms", *European Journal of Information Systems*, 11.

Jarvenpaa, S.L., and Ives, B. (1994). "The global network organization of the future: Information management opportunities and challenges". *Journal of Management Information Systems*, 10(4).

Keen, P.G.W. (1993). "Information Technology and the Management Difference: A Fusion Map," *IBM Systems Journal,* Vol. 32, No. 1.

Kearns, G.S. and Lederer, A.L. (2000). "The Effect of Strategic Alignment on the use of IS-Based Resources for Competitive Advantage," *Journal of Strategic Information Systems,* Vol. 9, No. 4.

Kearns, G.S. and Lederer, A.L. (2003). "A Resource-Based View of Strategic IT Alignment: How Knowledge Sharing Creates Competitive Advantage," *Decision Sciences*, Vol. 34, No. 1.

Kearns, G.S. and Lederer, A.L. (2004). "The impact of industry contextual factors on IT focus and the use of IT for competitive advantage," *Information & Management*, Vol. 41, pp. 899-919.

King, W.R. (1978). "Strategic Planning for Management Information Systems," *MIS Quarterly,* Vol. 2, No. 1, pp. 27-37.

Lind, M.R., and Zmud, R.W. (1991). "The influence of a convergence in understanding between technology providers and users on information technology innovativeness", *Organization Science,* 2(2).

Luftman, J.N., Lewis, P.R. and Oldach, S.H. (1993). "Transforming the Enterprise: The Alignment of Business and Information Technology Strategies," *IBM Systems Journal*, Vol. 32, No. 1.

Luftman, J.N., Brier, T. (1991). "Achieving and Sustaining Business-IT Alignment," *California Management Review*, Vol. 42, No. 1.

Luftman, J.N. (2003). "Assessing IT/Business Alignment," *Information Systems Management,* Vol. 20, No. 4.

Maes, R., Rijsenbrij, D., Truijens, O. and Goedvolk, H. (2000). "Redefining Business-IT Alignment through a Unified Framework," *PrimaVera Working Paper Series*, 2000-19.

Mata, F., Fuerst, W., and Barney, J. (1995). "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly*, 19(4).

Moody, K.V. (2003). "New Meaning to IT Alignment" *Information Systems Management,* Vol. 20, No. 4.

Palmer J.W., and Markus, M.L. (2000). "The performance impacts of quick response and strategic alignment in specialty retailing". *Information Systems Research*, 11(3).

Papp, R. (2001). "Strategic Information Technology: Opportunities for Competitive Advantage", IDEA Publishing Group.

Peak, D. and Guynes, S.C. (2003). "Improving Information Quality Through IT Alignment and Planning: A Case Study," *Information Systems Management,* Vol. 20, No. 4.

Peak, D., Guynes, S.C. and Kroon, V. (2005). "Information Technology Alignment Planning – A case study," *Information & Management,* Vol. 42, pp. 619-633.

Peppard, J. and Ward, J. (2004). "Beyond Strategic Information Systems: Towards an IS Capability," *Journal of Strategic Information Systems,* Vol. 13, No. 2.

Powell, T.C., and Dent-Micallef, A. (1997). "Information technology as competitive advantage: the role of human, business and technology resources", *Strategic Management Journal,* 18(5).

Pyburn, P.J. (1983). "Linking the MIS Plan with Corporate Strategy: An Exploratory Study," *MIS Quarterly*, Vol. 7, No. 2, pp. 1-14.

Reich, B.H. and Benbasat, I. (1996). "Measuring the Linkage between Business and Information Technology Objectives," *MIS Quarterly*, Vol. 20, No. 1, pp. 55-81.

Reich, B.H. and Benbasat, I. (2000). "Factors that Influence the Social Dimension of Alignment between Business and Information Technology Objectives," *MIS Quarterly*, Vol. 24, No. 1,pp. 81.

Sambamurthy, V. and Zmud, R.W. (1999). "Factors Influencing Information Technology Management Architectures in Organizations. A Theory of Multiple Contingencies," *MIS Quarterly,* Vol. 23, No. 2.

Sabherwal, R., Hirschheim R. and Goles T. (2001). "The Dynamics of Alignment: Insights from a Punctuated Equilibrium Model," *Organization Science*, 12(2), 179-197.

Sabherwal, R.and Chan, Y. E. (2001). "Alignment Between Business and IS Strategies: A Study of Prospectors, Analyzers, and Defenders," *Information Systems Research*, 12(1), pp. 11-33.

Sabherwal, R., and Kirs, P. (1994). "The alignment between organizational critical success factors and information technology capability in academic institutions", *Decision Sciences*, 25(2).

Segars, A.H., and Grover, V. (1999). "Profiles of strategic information systems planning", *Information Systems Research*, 10(3).

Smaczny, T. (2001). "IS an Alignment between Business and IT the Appropriate Paradigm to Manage IT in Today's Organisation?", *Management Decision,* 39 (10).

Stratopoulos, T., and Dehning, B. (2000). "Does successful investment in information technology solve the productivty paradox?" *Information and Management,* 38 (2).

Tallon, P.P., Kraemer, K.L., and Gurbaxani, V. (2000). "Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach," *Journal of MIS*, Vol. 16, No. 4, pp. 145-173.

Tallon, P.P. and Kraemer, K.L. (2003). "How Flexibility Shapes Strategic Alignment and IT Business Value: Uncovering an Alignment Paradox," *CRITO Working Paper* UC-Urvine.

Teo, T.S.H, and King, W.R. (1996). "Assessing the impact of integrating business planning and is planning*", Information and Management*, 30(6).

Teo, T.S.H and King, W.R. (1997). "Integration between business planning and information systems planning: an evolutionary-contingency perspective", *Journal of Management Information Systems,* 14(1).

Treacy, M., and Wiersema, F. (1997). "The discipline of market leaders: Choose your customers, narrow your focus, dominate your market", Perseus book group.

Voss, C.A. (1986). "Managing advanced manufacturing technology", *International Journal of Operations and Production Management*, 6 (5).

Weill, P. and Broadbent M. (1998). Leveraging the New Infrastructure: "How Market Leaders Capitalize on Information Technology," *Harvard Business School Press*, Boston, MA.